

Claims

We claim:

1. An apparatus used in monitoring the front surface of a wafer during a planarization process, comprising:
 - a) a source for producing an interrogation signal;
 - b) a plurality of probes adapted to transmit the interrogation signal to, and receive reflected interrogation signal from, a front surface of a wafer;
 - c) a metrology instrument for measuring the interrogation signal; and
 - d) a plurality of path ways for communicating the interrogation signal from the source to the probes and for communicating the reflected interrogation signal from the probes to the metrology instrument.
2. An apparatus used in monitoring the front surface of a wafer during a planarization process, comprising:
 - a) a light source for producing a light signal;
 - b) a plurality of probes adapted to transmit the light signal to, and receive reflected light from, a front surface of a wafer;
 - c) a metrology instrument for measuring the intensity of the reflected light; and
 - d) a plurality of fiber optic cables for communicating the light signal from the light source to the probes and for communicating the reflected light from the probes to the metrology instrument.
3. The apparatus of claim 2, wherein the metrology instrument is a spectrometer.
4. The apparatus of claim 3, wherein the probes and spectrometer are adapted for working with multi-frequency light.
5. The apparatus of claim 2, further comprising:
 - e) a working surface for planarizing the front surface of the wafer;
 - f) a carrier for retaining and pressing the front surface of the wafer against the working surface;
 - g) a rotational motion generator adapted for rotating the carrier; and

- h) an orbital motion generator adapted for orbiting the working surface.
- 6. The apparatus of claim 5, wherein the working surface is a polishing pad.
- 7. The apparatus of claim 6, wherein the plurality of probes extend through the polishing pad.
- 8. The apparatus of claim 6, wherein the probes are positioned beneath the polishing pad to monitor a plurality of annular areas that substantially cover the front surface of the wafer.
- 9. The apparatus of claim 6, wherein the probes transmit the light signal and receive the reflected light through the polishing pad.
- 10. The apparatus of claim 6, further comprising:
 - i) a plurality of windows in the polishing pad above the probes.
- 11. The apparatus of claim 6, wherein the polishing pad is transparent above the probes.
- 12. The apparatus of claim 8, wherein adjacent annular areas on the front surface of the wafer overlap.
- 13. The apparatus of claim 8, wherein the carrier is adapted to place a first pressing force on a first annular area on the back surface of the wafer and a second pressing force on a second annular area on the back surface of the wafer.
- 14. A method for planarizing a front surface of a wafer comprising the steps of:
 - a) pressing a front surface of a wafer against a working surface;
 - b) generating relative motion between the front surface of the wafer and the working surface;
 - c) transmitting a plurality of light signals to a plurality of bands on the front surface of the wafer;
 - d) receiving a plurality of reflected light signals from the plurality of bands with a plurality of probes;
 - e) communicating the reflected light from the plurality of probes to a metrology instrument;
 - f) analyzing the plurality of reflected light signals from the plurality of bands; and
 - g) altering the planarization process based on the analysis.

15. The method of claim 14 wherein the planarization process is altered by adjusting the pressure in one or more zones of a multizone carrier.
16. The method of claim 14 wherein the plurality of bands on the front surface of the wafer overlap.
17. The method of claim 14 wherein the generated relative motion comprises rotating the carrier and orbiting the working surface.
18. The method of claim 14 wherein the plurality of light signals comprise multiple frequencies.
19. The method of claim 14 wherein the metrology instrument comprises a spectrometer.